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MONTANA DEPARTMENT

OF

HEALTH AND ENVIRONMENTAL SCIENCES

MINIMUM DESIGN STANDARDS

FOR

SMALL WATER SYSTEMS

ATE DOCUMENTS COLLECTION

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1.0 GENERAL

All reports, final plans and specifications should be submitted at least 60 days prior to the date on which action by the department is desired. Preliminary plans and the design report may be submitted for review prior to the preparation of final plans. No approval for construction can be issued until final, complete, detailed plans and specifications have been submitted to the Department of Health and Environmental Sciences and found to be satisfactory. Documents submitted for formal approval shall include but not be limited to

a. a summary of the basic design,

b. operation requirements, where applicable,

c. general layout,

d. detailed plans, and

e. specifications.

1.1 DESIGN REPORT

The design report for water works improvements shall, where pertinent, present the following information:

1.1.1 General information,

including

a. identification of the area or facility served, and

b. name and mailing address of the owner.

1.1.2 Extent of water system,

including

a. description of the nature and extent of the area or facility to be served,

b. provisions for extending the water works system to include additional facilities, and

c. appraisal of the future requirements for service, including existing and potential water supply needs.

1.1.3 Alternate plans

Where two or more solutions exist for providing water supply facilities, each of which is feasible and practicable, discuss the alternate plans and give reasons for selecting the one recommended, including financial considerations.

1.1.4 Water use data,

including

a. the estimated population which will be served by the proposed water supply system or expanded system,

b. present water consumption (if available) and the projected average and maximum daily demands used as the basis of design, and

c. present and/or estimated yield of the sources of supply.

1.1.5 Sewerage system available

Describe the existing sewerage system and sewage treatment works with special reference to their relationship to existing or proposed water works structures which may affect the operation of the water supply system, or which may affect the quality of the supply.

1.1.6 Sources of water supply

Describe the proposed source or sources of water supply to be developed, including:

a. sites considered,

b. advantages of the site selected,

c. elevations with respect to surroundings, and

d. sources of possible contamination such as sewers and sewerage facilities, landfills, outcroppings of consolidated water-bearing formations, waste disposal wells, etc.

1.2 PLANS

Plans for water works improvements shall, where pertinent, provide the following:

1.2.1 General layout

including

a. suitable title,

b. name of entity or person responsible for the water supply,

c. area or facility to be served,

d. scale, in feet,

e. north point,

f. date, name and address of the designer

g. legible prints, and

h. location, nature and size of existing water facilities, if any.

1.2.2 Detailed plans,

including

a. arrangement of present or planned wells or structures,

b. location of all existing and potential sources of pollution within 250 feet of the source and within 100 feet of underground treated water storage facilities,

c. size, length and identity of sewers, drainfields and other sources of pollution and their locations relative to proposed water system,

d. piping in sufficient detail to show flow through the water system, including waste lines,

e. locations, dimensions and elevations of all proposed water system facilities,

f. locations of sampling taps, and

g. adequate description of any features not otherwise covered by the specifications.

1.3 SPECIFICATIONS

Complete, detailed, technical specifications shall be supplied for the proposed project.

2.0 (Reserved)

SOURCE DEVELOPMENT PART 3

3.0 GENERAL

In selecting the source of water to be developed, the designer must prove to the satisfaction of the department that an adequate quantity of water will be available, and that the water which is to be delivered to the consumers will meet the current requirements of the department.

3.1 (Reserved)

3.2 GROUND WATER

A ground water source includes all water from dug, drilled, bored or driven wells, and infiltration lines.

3.2.1 Quantity

3.2.1.1 Source Capacity

The total developed ground water source capacity shall equal or exceed the design maximum day demand.

3.2.1.2 Water use estimates for design purposes

a. Domestic use - 100 gpcd shall be provided for average domestic use unless the designer has sufficient data, acceptable to the department, to show a lesser quantity to be adequate.

b. Irrigation - when irrigation water is provided, information must be submitted to show that adequate water will be available. Such information must include:

- the area to be irrigated in acres or square feet,
- water requirements in inches/week,
- proposed methods of controlling irrigation beyond the capacity of the system.

c. Fire flows - fire flows must meet the current department minimum standards.

3.2.2. Quality

3.2.2.1 Microbiological quality

a. Disinfection of every new, modified or reconditioned ground water source shall be provided after placement of permanent pumping equipment.

b. After disinfection, one or more water samples shall be submitted to a laboratory certified by the department for microbiological analysis with satisfactory results reported to the department prior to placing the well into service.

3.2.2.2 Physical and chemical quality

a. Every new, modified or reconditioned ground water source shall be examined for applicable physical and chemical chacteristics by tests of a representative sample in a laboratory certified by the department, with the results reported to the department.

i. Such testing shall include nitrates and total dissolved solids or conductivity as a minimum. Additional testing may be required for other parameters where the department has information suggesting they may be present in harmful quantities.

ii. The above testing may be waived where information submitted confirms water quality will be acceptable.

b. Samples shall be collected at the conclusion of the test pumping procedure and examined as soon as practical.

3.2.3 Location

3.2.3.1 Well location

Regarding a proposed well location the department shall be consulted prior to design and construction as the location relates to required separation between existing and potential sources of contamination and ground water development.

3.2.3.2 Continued protection

Continued protection of the well site from potential sources of contamination shall be provided either through ownership, zoning, easements, leasing or other means acceptable to the department. Such protection shall extend for at least a 100 feet radius around the well. Fencing of the site may be required by the department.

3.2.4 Testing and Records

3.2.4.1 Yield and drawdown tests shall

a. be performed on every production well after construction or subsequent treatment and prior to placement of the permanent pump,

b. have the test methods clearly indicated in specifications,

c. provide recordings and graphic evaluation of the following at one hour intervals or less as may be required by the department:

1. pumping rate,
2. pumping water level,
3. drawdown, and
4. water recovery rate and levels

d. provide for continuous pumping for at least 24 hours or until stabilized drawdown has continued for at least six hours when test pumped at 1.5 times the design pumping rate, and

e. provide the following data:

1. test pump capacity-head characteristics,
2. static water level,
3. depth of test pump setting, and
4. time of starting and ending each test cycle.

3.2.4.3 Geological data shall

a. be determined from samples collected at regular intervals and at each pronounced change in formation,

b. be recorded on well log and submitted to the department, and

c. be supplemented with information on accurate record of drillhole diameters and depths, assembled order of size and length of casings and liners, grouting depths, formations penetrated, water levels and location of any blast charges.

3.2.5 General well construction

3.2.5.1 Minimum Protected Depths

Wells should be a minimum of 25 feet deep. Wells drawing water from less than 25 feet must provide full time disinfection with 30 minutes contact time, unless deviation is granted by the department.

3.2.5.2 Permanent steel casing pipe shall

a. be new pipe meeting ASTM or API specifications for water well construction,

b. be capable of withstanding forces to which it is subjected,

c. be equipped with a drive shoe when driven, and

d. have full circumferential welds or threaded coupling joints.

3.2.5.3 Nonferrous casing materials

a. Approval of the use of any nonferrous material as well casing shall be subject to special determination by the

department prior to submission of plans and specifications.

3.2.5.4 Packers

Packers shall be of material that will not impart taste, odor, toxic substance or bacterial contamination to the well water.

3.2.5.5 Grouting requirements

All permanent well casing, except driven Schedule 40 steel casing with the approval of the department, shall be surrounded by a minimum of 1 1/2 inches of grout to at least 12 feet below the ground surface. All temporary construction casings should be removed, but shall be withdrawn at least five feet to insure grout contact with the native formation.

3.2.5.6 Upper terminal well construction

a. Permanent casing for all ground water sources shall project at least 12 inches above the pumphouse floor or concrete apron surface and at least 18 inches above final ground surface.

b. Where a well house is constructed, the floor surface shall be at least six inches above the final ground elevation.

c. Sites subject to flooding shall be provided with an earth berm surrounding the casing and terminating at an elevation at least two feet above the highest known flood elevation, or other suitable protection as approved by the department.

d. The top of the well casing at sites subject to flooding shall terminate at least five feet above the highest known flood elevation or as the department directs.

3.2.5.7 Development

a. Every well shall be developed to remove the native silts and clays, drilling mud and/or finer fraction of the gravel pack.

3.2.5.8 Capping requirements

a. A welded metal plate or a threaded cap is the preferred method for capping a well.

b. A properly fitted, firmly driven solid wooden plug is the minimum acceptable method of capping a well until pumping equipment is installed.

c. At all times during the progress of work, the contractor shall provide protection to prevent tampering with the well or entrance of foreign materials.

3.2.5.10 Well abandonment

a. Test wells and ground water sources which are not in use shall be sealed by such methods as necessary to restore the controlling geological conditions which existed prior to construction or as directed by the department.

3.2.6 Aquifer types and construction methods - special conditions

The following special aquifer types and construction methods shall be reviewed by the department on a case by case basis to assure proper design and protection of public health:

a. sand or gravel wells,

b. gravel pack wells,

c. radial wells,

d. infiltration lines,

e. dug wells,

f. limestone or sandstone wells, and

g. flowing wells.

3.2.7 Well pumps, discharge piping and appurtenances

3.2.7.1 Submersible pumps

Where a submersible pump is used

a. the top of the casing shall be effectively sealed against the entry of water under all conditions of vibration or movement of conductors or cables.

3.2.7.2 Discharge piping

a. The discharge piping shall

1. have control valves and appurtenances located above the pumphouse floor when an above-ground discharge is provided,

2. be protected against the entry of contamination,

3. be equipped with a check valve, a shutoff valve, a pressure gauge, and a sampling tap located at a point where positive pressure is maintained,

4. where applicable, be equipped with an air release-vacuum relief valve located upstream from the check valve, with exhaust/relief piping terminating in a down-turned position at least 18 inches above the floor and covered with a 24 mesh corrosion resistent screen,

5. be valved to permit test pumping and control of each well, and

6. have all exposed piping, valves and appurtenances protected against physical damage and freezing,

b. The discharge piping ~~should~~ shall be provided with a means of pumping to waste, but shall not be directly connected to a sewer.

3.2.7.3 Pitless well units and adapters

a. The department must be contacted for approval of specific applications of pitless units and pitless adapters.

3.2.7.4 Casing vent

Provisions should be made for venting the well casing to atmosphere. The vent shall terminate in a downturned position, at or above the top of the casing or pitless unit in a minimum 1 1/2 inch diameter opening covered with a 24 mesh, corrosion resistant screen. The pipe connecting the casing to the vent shall be of adequate size to provide rapid venting of the casing.

3.2.7.5 Water level measurement

a. Installation of permanent water level measuring equipment shall be made using corrosion resistant materials attached firmly to the drop pipe or pump column and in such a manner as to prevent entry of foreign materials.

4.0 GENERAL

The need for and design of treatment processes and devices shall depend on evaluation of the nature and quality of the particular water to be treated and the desired quality of the finished water. The department shall use "Recommended Standards for Water Works", 1982 Edition as a guide for the review and approval of treatment processes and equipment.

5.0 GENERAL

No chemicals shall be applied to drinking water unless specifically permitted or required by the department. Chemical application should be designed to meet the requirements of "Recommended Standards for Water Works", 1982 edition.

6.0 GENERAL

Pumping facilities shall be designed to maintain the sanitary quality of pumped water. Subsurface pits or pump rooms and inaccessible installations should be avoided. No pumping station shall be subject to flooding.

6.1 LOCATION

The pumping station shall be so located that the proposed site will meet the requirements for sanitary protection of water quality, hydraulics of the system and protection against interruption of service by fire, flood or any other hazard.

6.2 PUMPS

At least two pumping units should be provided. With any pump out of service, the remaining pump or pumps shall be capable of providing the maximum daily pumping demand of the system.

6.3 APPURTENANCES

6.3.1 Valves

Pumps shall be adequately valved to permit satisfactory operation, maintenance and repair of the equipment. If foot valves are necessary, they shall have a net valve area of at least 2 1/2 times the area of the suction pipe and they shall be screened. Each pump shall have a postive-acting check valve on the discharge side between the pump and the shut-off valve.

6.3.2 Piping

In general piping shall

a. be designed so that the friction losses will be minimized,

b. not be subject to contamintion,

c. have watertight joints,

d. be protected against surge or water hammer, and

e. be such that each pump has an individual suction line or that the lines shall be so manifolded that they will insure similar hydraulic and operating conditions.

6.3.3 Gauges and meters

Each pump

a. shall have a standard pressure gauge on its discharge line,

b. should have a compound gauge on its suction line, and

c. shall have a means for measuring the discharge.

FINISHED WATER STORAGE PART 7

7.0 GENERAL

The materials and designs used for finished water storage structures shall provide stability and durability as well as protect the quality of the stored water. Steel structures shall follow the current AWWA standards concerning steel tanks, standpipes, reservoirs, and elevated tanks wherever they are applicable. Other materials of construction are acceptable when properly designed to meet the requirements of Part 7 of "Recommended Standards for Water Works", 1982 Edition.

7.1 PRESSURE TANKS

Hydropneumatic (pressure) tanks, when provided as the only storage facility, are acceptable only in small water systems.

7.1.1 Location

The tank shall be located above normal ground surface and be completely housed.

7.1.2 System design and sizing

The following must be considered during design of pressure tank systems.

a. pumphouse layout and valving,

b. pressure tank efficiency,

c. pump efficiency,

d. pumping rates,

e. pressure tank volume, and

f. peak demands of system.

8.0 MATERIALS

8.0.1 Standards

Pipes, fittings, valves and fire hydrants should conform to the latest standards issued by the AWWA, if such standards exist, and be acceptable to the department. In the absence of such standards, materials meeting applicable Product Standards and acceptable to the department may be selected.

8.1 WATER MAIN DESIGN

The normal working pressure in the distribution system should be approximately 60 psi and shall not be less than 35 psi.

8.1.1 Pressure

The system shall be designed to maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow.

8.1.2 Diameter

The mains must be sized to handle design flows.

8.1.3 Hydrants

Water mains not designed to carry fire-flows shall not have fire hydrants connected to them.

8.1.4 Dead ends

Dead ends shall be minimized by looping of all mains whenever practical.

8.2 VALVES

Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs.

8.3 INSTALLATION OF MAINS

8.3.1 Standards

Specifications shall incorporate the provisions of the AWWA standards and/or manufacturer's recommended installation procedures.

8.3.2 Cover

All water mains shall be covered with sufficient earth or other insulation to prevent freezing.

8.3.3 Pressure and leakage testing

The installed pipe shall be pressure tested and leakage tested as required by the department.

8.3.4 Disinfection

All new, cleaned or repaired water mains shall be disinfected in accordance with AWWA Standard C601. The specifications shall include detailed procedures for the adequate flushing, disinfection, and microbiological testing of all water mains.

8.4 SEPARATION OF WATER MAINS AND SEWERS

8.4.1 Parallel installation

Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge.

8.4.2 Crossings

Water mains crossing sewers shall be laid to provide a minimum distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.

8.5 CROSS CONNECTIONS AND INTERCONNECTIONS

8.5.1 Cross connections

There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contaminating materials may be discharged or drawn into the system.

8.6 WATER SERVICES AND PLUMBING

8.6.1 Plumbing

Water services and plumbing shall conform to relevant local and/or state plumbing codes, or to the National Plumbing Code.

8.6.2 Booster pumps

Individual home booster pumps shall not be considered or required for any individual service from the water supply mains unless specifically approved by the department.

9.0 GENERAL

The department may grant a deviation from these design standards when the designer for the system has demonstrated to the satisfaction of the department that strict adherence to the standards is not necessary to protect public health.